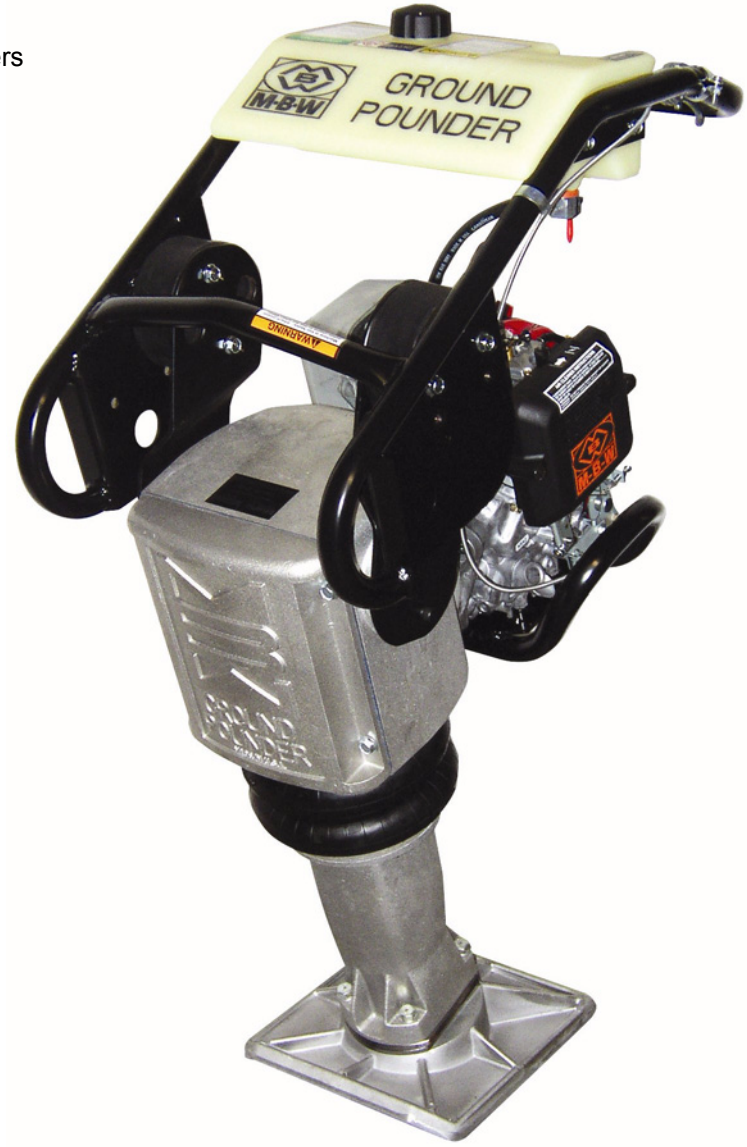
Operator's Safety and Service Manual

R420

This manual covers the following serial numbers and higher for each model listed:

420R 4200395
420H 4250487
420HC 4271101



Smart Rammers

MBW, Inc.
250 Hartford Rd • PO Box 440
Slinger, WI 53086-0440
Phone: (262) 644-5234
Fax: (262) 644-5169
Email: mbw@mbw.com
Website: www.mbw.com

MBW (UK) Ltd.
Units 2&3 CochraneStreet
Bolton BL3 6BN
Phone: 01404 387784
Fax: 01204 387797

MBW FRANCE S.A.R.L.
Z.A. d'Outreville
11 rue Jean Baptiste Néron,
60540 BORNEL
FRANCE
Teléfono: +33 (0) 3 44 07 15 96
Fax: +33 (0) 3 44 07 41 28
Correo electrónico: mbwfrance@free.fr

L16770 / 06.08.T
©MBW, Inc. 2006
Printed in the USA

Table Of Contents

Safety Information 1

Introduction 1
Safety Precautions 1
Safety Decals 1

Specifications. 3

Operation 4

Introduction 4
Before Starting & Operating 4
Starting Engine 4
Operating 4
Stopping Engine 4
Lifting and Transporting 4

Maintenance 5

Maintenance Schedule 5
Fluid Levels. 5
Engine Maintenance 5
Engine Speed 5
Checking Percussion System Oil 5
Changing Percussion System Oil 6

Service 7

Torque Chart 7
Service Tools 7
General. 7
Handle Removal. 7
Engine Removal 7
Clutch Removal 8
Gearbox Removal 8
Gearbox Disassembly 8
Gearbox Assembly 9
Lower Unit Disassembly. 10
Lower Unit Assembly 10
Gearbox and Lower Unit Assembly 11
Parts Replacement Cycles and Tolerances 12

Replacement Parts. 13

Gearbox Assembly 14
Lower Unit Assembly 16
Gearbox and Lower Unit Assembly 18
Handle Assembly 20
Handle Assembly 22
Engine Assembly 24

Warranty 26

This page intentionally left blank.

SAFETY INFORMATION

Introduction

This Safety Alert Symbol is used to call attention to items or operations which may be dangerous to those operating or working with this equipment. The symbol can be found throughout this manual and on the unit. Please read these warnings and cautions, along with all decals, carefully before attempting to operate the unit. Make sure every individual who operates or works with this equipment is familiar with all safety precautions.

⚠ WARNING ⚠

GENERAL WARNING. Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment and/or severe bodily injury or death.

⚠ CAUTION ⚠

GENERAL CAUTION. Indicates information important to the proper operation of the equipment. Failure to observe may result in damage to the equipment.

Safety Precautions

LETHAL EXHAUST GAS: An internal combustion engine discharges carbon monoxide, a poisonous, odorless, invisible gas. Death or serious illness may result if inhaled. Operate only in an area with proper ventilation. NEVER OPERATE IN A CONFINED AREA!

DANGEROUS FUELS: Use extreme caution when storing, handling and using fuels, as they are highly volatile and explosive in vapor state. Do not add fuel while engine is running. Stop and cool the engine before adding fuel. DO NOT SMOKE!

SAFETY GUARDS: It is the owner's responsibility to ensure that all guards and shields are in place and in working order.

IGNITION SYSTEMS: Breakerless, magneto, and battery ignition systems can cause severe electrical shocks. Avoid contacting these units or their wiring.

SAFE DRESS: Do not wear loose clothing, rings, wristwatches, etc. near machinery.

NOISE PROTECTION: Wear OSHA specified hearing protection devices.

EYE PROTECTION: Wear OSHA specified eye shields, safety glasses, and sweat bands.

FOOT PROTECTION: Wear OSHA specified steel-tipped safety shoes.

HEAD PROTECTION: Wear OSHA specified safety helmets.

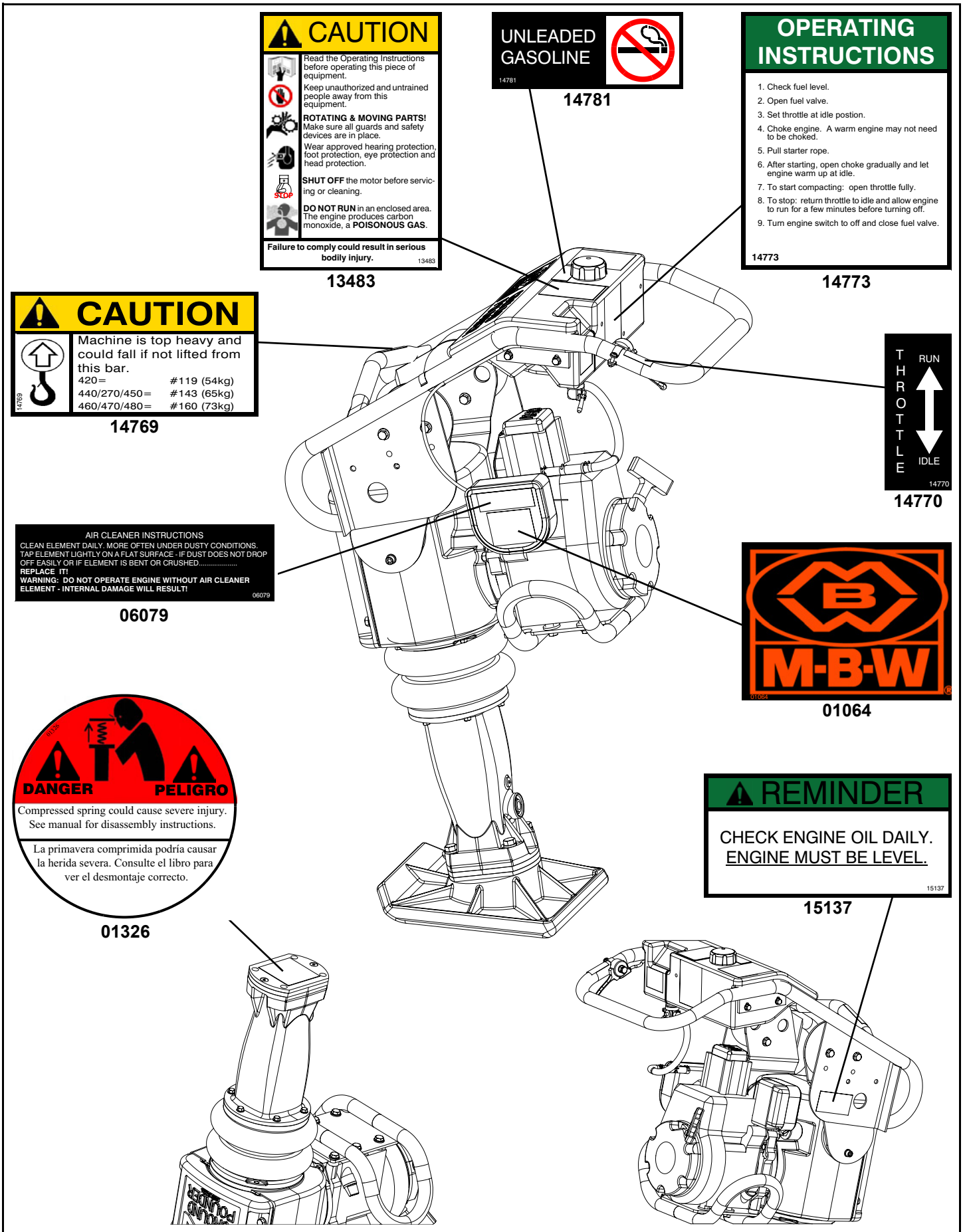
DUST PROTECTION: Wear OSHA specified dust mask or respirator.

OPERATOR: Keep children and bystanders off and away from the equipment.

REFERENCES: For details on safety rules and regulations in the United States, contact your local Occupational Safety and Health Administration (OSHA) office. Equipment operated in other countries must be operated and serviced in accordance and compliance with any and all safety requirements of that country. The publication of these safety precautions is done for your information. MBW does not by the publication of these precautions, imply or in any way represent that these are the sum of all dangers present near MBW equipment. If you are operating MBW equipment, it is your responsibility to insure that such operation is in full accordance with all applicable safety requirements and codes. All requirements of the United States Federal Occupational Safety and Health Administration Act must be met when operated in areas that are under the jurisdiction of that United States Department.

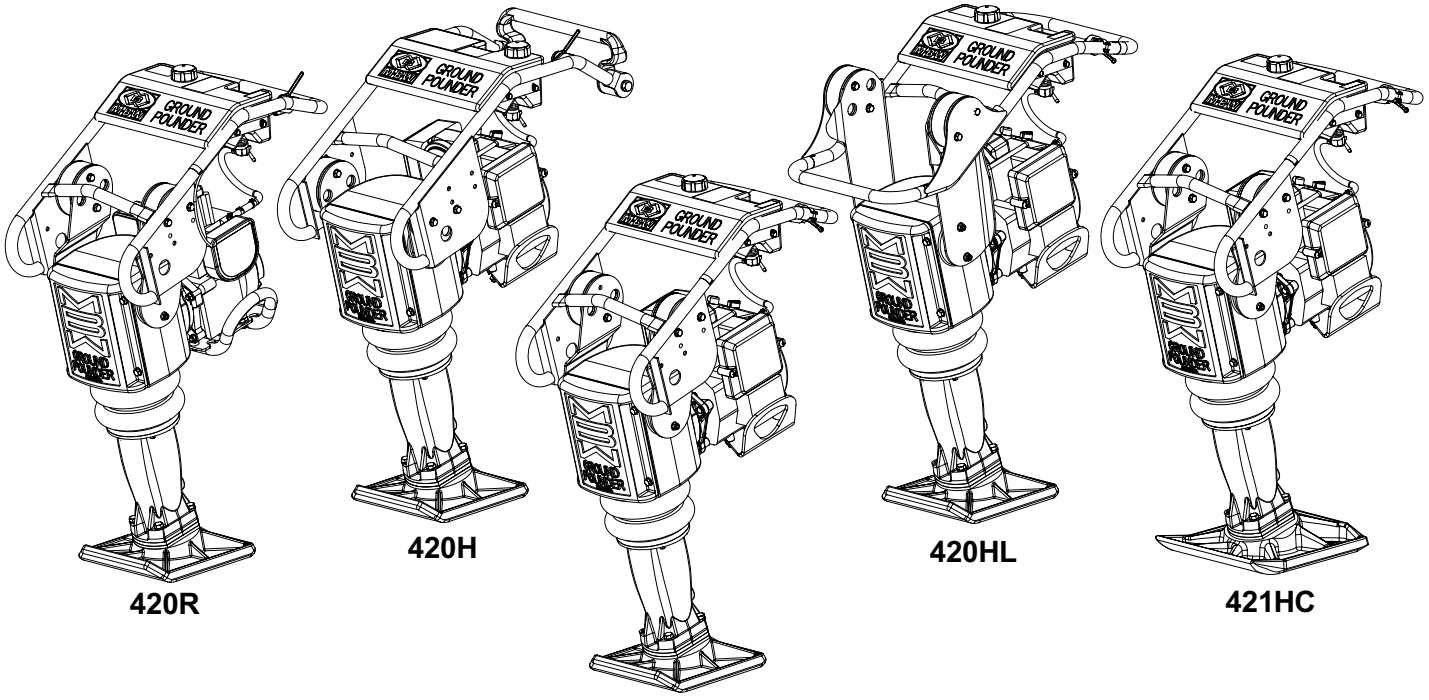
Safety Decals

Carefully read and follow all safety decals. Keep them in good condition. If decals become damaged, replace as required. If repainting the unit, replace all decals. Decals are available from authorized MBW distributors. Order the decal set listed on the following page(s).


CAUTION
Read the Operating Instructions before operating this piece of equipment.
Keep unauthorized and untrained people away from this equipment.
ROTATING & MOVING PARTS! Make sure all guards and safety devices are in place.
Wear approved hearing protection, foot protection, eye protection and head protection.
SHUT OFF the motor before servicing or cleaning.
DO NOT RUN in an enclosed area. The engine produces carbon monoxide, a POISONOUS GAS.
Failure to comply could result in serious bodily injury.
13483
13483
UNLEADED GASOLINE
14781
14781
OPERATING INSTRUCTIONS
1. Check fuel level.
2. Open fuel valve.
3. Set throttle at idle postion.
4. Choke engine. A warm engine may not need to be choked.
5. Pull starter rope.
6. After starting, open choke gradually and let engine warm up at idle.
7. To start compacting: open throttle fully.
8. To stop: return throttle to idle and allow engine to run for a few minutes before turning off.
9. Turn engine switch to off and close fuel valve.
14773
14773
CAUTION
Machine is top heavy and could fall if not lifted from this bar.
420= #119 (54kg)
440/270/450= #143 (65kg)
460/470/480= #160 (73kg)
14769
14769
THROTTLE
RUN
IDLE
14770
14770
AIR CLEANER INSTRUCTIONS
CLEAN ELEMENT DAILY. MORE OFTEN UNDER DUSTY CONDITIONS. TAP ELEMENT LIGHTLY ON A FLAT SURFACE - IF DUST DOES NOT DROP OFF EASILY OR IF ELEMENT IS BENT OR CRUSHED.....
REPLACE IT!
WARNING: DO NOT OPERATE ENGINE WITHOUT AIR CLEANER ELEMENT - INTERNAL DAMAGE WILL RESULT!
06079
06079
M-B-W
01064
01064
DANGER
PELIGRO
Compressed spring could cause severe injury. See manual for disassembly instructions.
La primavera comprimida podría causar la herida severa. Consulte el libro para ver el desmontaje correcto.
01326
01326
REMINDER
CHECK ENGINE OIL DAILY.
ENGINE MUST BE LEVEL.
15137
15137

Safety Decals (Decal Set #17777)

SPECIFICATIONS



420R 420H 420HC 420HL 421HC

	420R	420H/420HC	420HL	421HC
Operating Weight - lbs(kg)	118 (53.5)	126 (57.1)	134 (60.8)	128 (58.1)
Height - in(cm)	38.25 (97.2)	38.25 (97.2)	38.25 (97.2)	38.25 (97.2)
Width - in(cm)	14.25 (36.2)	14.25 (36.2)	14.25 (36.2)	14.25 (36.2)
Length - in(cm)	26 (66)	26.88 (68.3)	28.25 (71.8)	26.88 (68.3)
Engine	Robin EH09	Honda GX100	Honda GX100	Honda GX100
Shoe (W x L) in(cm)	10 x 11.5 (25.4 x 29.2)	10 x 11.5 (25.4 x 29.2)	10 x 11.5 (25.4 x 29.2)	11 x 13 (28 x 33)
Operating Noise Level[1] dBa	93 dBA	93 dBA	93 dBA	93 dBA
Compaction Force lbf(kN)	3000 (13.3) per blow	3100 (13.8) per blow	3200 (13.8) per blow	3200 (13.8) per blow
Travel Speed ft/min(m/min)	55 (16.8)	55 (16.8)	55 (16.8)	55 (16.8)
Compaction Area sqft/hr (sqm/hr)	2520 (234)	2520 (234)	2520 (234)	2772 (257)
Percussion Rate blows/min	up to 720	up to 720	up to 720	up to 720
Engine Speed rpm	3500-3600	3500-3600	3500-3600	3500-3600
Fuel Capacity - gal(L)	1.1 (4.2)	1.1 (4.2)	1.1 (4.2)	1.1 (4.2)
Gearbox Oil Capacity ounces(L)	10 (0.3)	10 (0.3)	10 (0.3)	10 (0.3)
Engine Oil Capacity ounces(L)	10 (0.3)	9.6 (0.28)	9.6 (0.28)	9.6 (0.28)

Specifications subject to change without notice

1. Noise levels are taken at the operating position and are based on operating conditions. Background noise will increase noise levels.
2. Noise level is operating on loose gravel surface. Hearing protection may be needed.
3. Not all product variations shown.

OPERATION

Introduction

MBW equipment is intended for use in very severe applications. They are powered by four cycle engines and are available in different sizes and a selection of engines.

This parts manual contains only standard parts. Variations of these parts as well as other special parts are not included. Contact your local MBW distributor for assistance in identifying parts not included in this manual.

Before Starting & Operating

- REMEMBER! It is the owner's responsibility to communicate information on the safe use and proper operation of this unit to the operators.
- Review ALL of the Safety Precautions listed on page 1 of this manual.
- Familiarize yourself with the operation of the machine and confirm that all controls function properly.
- Know how to STOP the machine in case of an emergency.
- Make sure hands, feet, and clothing are at a safe distance from any moving parts.
- OIL LEVEL - Check the oil level in the engine. For more information see "Lubrication" under the respective engine's "Owners Manual" or the Maintenance section of this manual.
- AIR CLEANER - Check to ensure element is in good condition and properly installed.
- FUEL SUPPLY - The engines on MBW equipment require an automotive grade of clean, fresh, unleaded gasoline.
- FUEL FILTER - If clogged or damaged, replace.

Starting Engine

For detailed instructions refer to the engine "Owner's Manual".

1. Open fuel valve.
2. Turn engine switch to "ON".
3. Set throttle to idle.

⚠ CAUTION ⚠

The engine speed must NOT be high enough to engage the clutch.

4. Choke engine if necessary (you may not need to choke a warm engine).
5. Pull starter rope repeatedly until engine starts.
6. Move choke lever to open position.
7. Allow engine to warm up for one or two minutes.

Operating

1. Familiarize yourself with the balance of the rammer before using it in job conditions. Due to the inherent design, the machine is top heavy and could tip over.
2. After the engine warms up, open the throttle fully for normal operation.
3. On uneven terrain, pushing down on the handle will aid climbing ability.

⚠ WARNING ⚠

Do not bear down (body weight of operator) on the machine.

4. After 3 passes, the rammer may have more kick back, this is an indication that ideal compaction is being reached.

Stopping Engine

1. Move throttle to idle position.
2. Let engine idle for one or two minutes.
3. Turn switch on engine to "STOP" position.
4. Turn off fuel valve.

⚠ WARNING ⚠

Always stop the engine before:

Adding fuel.

Leaving the equipment unattended for any amount of time.

Before making any repairs or adjustments to the machine.

Lifting and Transporting

1. The unit may be lifted by the handle and engine guard.
2. The unit should be transported laying face down
3. Secure it in place by the handle and shoe. DO NOT lay the unit on its sides or face up during transport.

MAINTENANCE

⚠ WARNING ⚠

Always exercise the stopping procedure before servicing or lubricating the unit.

After servicing the unit, replace and fasten all guards, shields, and covers to their original positions before resuming operation.

⚠ CAUTION ⚠

Always verify fluid levels and check for leaks after changing fluids.

Do not drain oil onto ground, into open streams, or down sewage drains.

Maintenance Schedule

SYSTEM	MAINTENANCE	DAILY	EVERY 25 HOURS	EVERY 300 HOURS	YEARLY
Air Cleaner	Check and clean	X			
Engine	Refer to engine operator/owner manual	X			
Hardware	Check and tighten as needed[1]		X		X
In Line Fuel Filter	Replace			X	X
Percussion System	Check oil level	X			
	Change oil[2]			X	X
Shockmounts	Check for cracks or deterioration				X
Spark Plug	Replace			X	X

1. Check all hardware after the first 5 hours of use, then follow the maintenance schedule.
2. Change oil in lower unit after the first 50 hours of operation, then follow the maintenance schedule.

Fluid Levels

SYSTEM	FLUID VOLUME	RECOMMENDED OIL
Percussion System	10 oz	SF SAE 10W-30 Motor Oil
Engine	Refer to engine operator/owner manual	

Engine Maintenance

Refer to the engine owner's manual for maintenance intervals and procedures.

- Check and clean the air cleaner element at least once daily, The air cleaner has a foam pre-cleaner that can be washed.
- Check the engine oil level by removing the dipstick (the engine must be level). The oil level should be between the marks on the dipstick. See the "Check Engine Oil" section of the engine "Owner's Manual" for information.
- See the "Change Engine Oil" section of the engine "Owner's Manual" for information on the oil change intervals.

Engine Speed

Engine speed is factory set according to the speed listed in the Specifications section of this manual. Refer to the engine owners manual for procedure on setting operating speed if necessary.

Checking Percussion System Oil

Refer to Lower Unit Assembly, page 16.

The rammer percussion system and gearbox are lubricated by an oil mist which is formed and carried throughout the rammer by a pumping action in the machine's lower system.

1. Before daily operation, place the rammer on a flat surface and check the oil level in the glass sight (#2) on the springbox guard (#11).

2. If the oil is not visible in the sight gauge, add oil as required. See Fluid Levels for recommeneded type of oil.

Changing Percussion System Oil

Refer to Lower Unit Assembly, page 16.

1. Remove the drain plug (#4) above the sight glass (#2) on the back of the springbox guard (#9).
2. Place an oil drain pan behind the shoe and tip the rammer back so the handle is on the ground.
3. Elevate the shoe until the lower assembly is horizontal. Hold this position until the oil is completely drained.
4. With the handle still on the ground, remove the four hex head flange screws (page 18, #8) holding the cover (page 18, #2) to the gearbox (page 18, #4).
5. Remove the cover, the cover gasket (page 18, #6), and the dowel pins (page 18, #1) from the gearbox.
6. Tip the unit forward and drain any oil into an oil pan.
7. After the oil has drained out, replace the dowel pins, gasket, and cover and secure with the four hex head flange screws.
8. Tip the rammer onto it's face and fill according to the Fluid Levels section in this manual.
9. Replace the drain plug.

Assembly and disassembly should be performed by a service technician who has been factory trained on MBW equipment. The unit should be clean and free of debris. Pressure washing before disassembly is recommended.

- Prior to assembly, wash all parts in a suitable cleaner or solvent.
- Check moving parts for wear and failure. Refer to the Replacement section in this manual for tolerance and replacement cycles.
- All shafts and housings should be oiled prior to pressing bearings. Also, ensure that the bearings are pressed square and are seated properly.
- All bearings should be replaced when rebuilding any exciter or gearbox.
- All gaskets and seals should be replaced after any disassembly.

Torque Chart

SIZE	GRADE 2	GRADE 5	GRADE 8
1/4-20	49 in•lbs	76 in•lbs	9 ft•lbs
1/4-28	56 in•lbs	87 in•lbs	10 ft•lbs
5/16-18	8 ft•lbs	13 ft•lbs	18 ft•lbs
5/16-24	9 ft•lbs	14 ft•lbs	20 ft•lbs
3/8-16	15 ft•lbs	23 ft•lbs	33 ft•lbs
3/8-24	17 ft•lbs	26 ft•lbs	37 ft•lbs
7/16-14	24 ft•lbs	37 ft•lbs	52 ft•lbs
7/16-20	27 ft•lbs	41 ft•lbs	58 ft•lbs
1/2-13	37 ft•lbs	57 ft•lbs	80 ft•lbs
1/2-20	41 ft•lbs	64 ft•lbs	90 ft•lbs
9/16-12	53 ft•lbs	82 ft•lbs	115 ft•lbs
5/8-11	73 ft•lbs	112 ft•lbs	159 ft•lbs
5/8-18	83 ft•lbs	112 ft•lbs	180 ft•lbs
3/4-16	144 ft•lbs	200 ft•lbs	315 ft•lbs
1-8	188 ft•lbs	483 ft•lbs	682 ft•lbs
1-14	210 ft•lbs	541 ft•lbs	764 ft•lbs
1-1/2-6	652 ft•lbs	1462 ft•lbs	2371 ft•lbs
M 6	3 ft•lbs	4 ft•lbs	7 ft•lbs
M 8	6 ft•lbs	10 ft•lbs	18 ft•lbs
M 10	10 ft•lbs	20 ft•lbs	30 ft•lbs

CONVERSIONS

in•lbs x 0.083 = ft•lbs

ft•lbs x 12 = in•lbs

ft•lbs x 0.1383 = kg•m

ft•lbs x 1.3558 = N•m

Service Tools

Part No.	Description
01629	Rubber Test Mat
06468	Springbox Tool
07205	Bellows Installation Tool
07353	Clutch Removal Tool
07552	Blind Hole Bearing Puller Tool

General

The disassembly and assembly procedures given on the next few pages are intended for a complete dismantling of the rammer. Read the following sections carefully. It is not necessary to follow the complete disassembly procedure when only partial disassembly is required. If repairs have to be made to the Lower Assembly only, it is recommended that the drive unit (engine, gearbox and handle) be removed from the lower unit. See “Lower Unit Disassembly”.

Handle Removal

Refer to Handle Assembly, page 20.

1. Turn the fuel valve (#11) to the "off" position.
2. Loosen the hose clamp (#3) at the engine end of the fuel line (#9). Disconnect the fuel line.
3. Remove the hardware holding the throttle (#8) to the handle (#21 or #24).
4. Remove the four flange head cap screws and flange bolts (#28 & #30) securing the handle to the torsion mounts (#6).
5. Lift the handle from the rammer.

Engine Removal

NOTE: It is not necessary to remove the handle to take the engine off the machine.

Refer to Engine Assembly, page 24.

For 420R machines with Robin EH09 engine

1. Follow steps 1 through 3 under "Handle Removal".
2. Remove the two metric hex head flange screws (page 20, #35) securing the engine guard (page 20, #16) to the engine adapter plate (#5).
3. While supporting the engine (#6), remove the four hex nuts and lockwashers (#19 & #13) holding the engine to the adapter plate.
4. Remove the engine and engine guard from the rammer.

For 420H and 420HC machines with Honda GX100 engine

1. Follow steps 1 through 3 under "Handle Removal".
2. Remove the four metric hex head flange screws (page 20, #36) securing the engine guard (page 20, #20) to the engine (#7).
3. While supporting the engine, remove the four hex flange nuts (#12) holding the engine and engine adapter plate (#9) to the studs (#8).
4. Remove the engine, engine adapter plate, and engine guard from the rammer.

Clutch Removal

Refer to Engine Assembly, page 24.

1. Remove the jam nut and key. Slide the clutch off engine crank.
2. Reinstall the clutch. Carefully insert woodruff key making sure key remains aligned with keyway
3. Reinstall jam nut with medium strength thread locker and tighten to 60 ft lbs (N•m).

Gearbox Removal

NOTE: It is necessary to remove the Handle and the Engine to remove the Gearbox.

Refer to Gearbox and Lower Unit Assembly, page 18.

1. Drain the oil from the rammer following steps 1 through 3 under “Changing Percussion System Oil” on page 6.
2. Replace the drain plug.
3. Remove the four hex head flange screws (#8) holding the cover (#2) to the gearbox (#4).

⚠ CAUTION ⚠

NOTE: There may be oil in the gearbox. Tip the unit back when removing the cover from the gearbox.

4. Remove the cover, the cover gasket (#6), and the dowel pins (#1) from the gearbox.
5. Tip the unit forward and drain any oil into an oil pan.
6. Loosen the hex nut (#10) on top of the ram head and remove the setscrew (#9).
7. Insert the setscrew into the piston pin (#5) and remove the piston pin. See Figure 1.

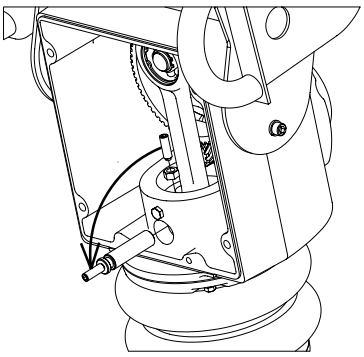


Figure 1

8. Remove the six hex head flange screws (page 16, #19) holding the springbox guard (page 16, #9) to the bottom bellows ring (page 16, #3).
9. Remove the gearbox assembly from the lower unit assembly. See Figure 2.

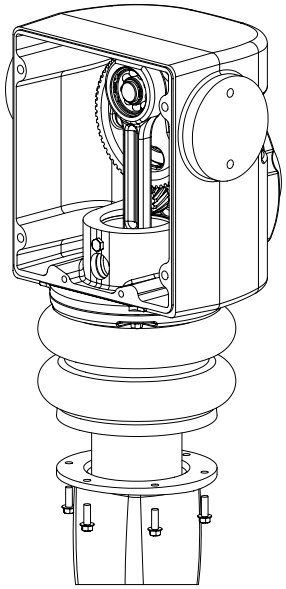


Figure 2

Gearbox Disassembly

Refer to Gearbox Assembly, page 14.

Crank Gear Removal

1. Slip a retaining ring pliers through the slot opening in the crank gear (#20) and remove the retaining ring (#10) from the housing. The retaining ring will remain between the crank gear and the bearing.
2. Remove the SAE plug (#19) from the rear of the gearbox. Use a 3/8 in (10mm) diameter steel rod to press the crank gear out of the gearbox.
3. Remove the ball bearing (#2) from the crank gear using a bearing puller. Remove the large retaining ring (#1) from the back of the crank gear.
4. Remove the small retaining ring (#9) from the front of the offset shaft on the crank gear and remove the connecting rod (#5).

5. Remove the needle bearing (#6) from the gearbox with a blind hole bearing puller tool (MBW #07552).

Pinion Removal

1. Remove the external retaining ring (#4) from the gear end of the pinion (#21) on the inside of the gearbox. If the retaining ring is pinched in its groove, tap the pinion on the drum side. This will relieve the pressure on the retaining ring.
2. Press out the pinion.
3. Pry out the oil seal (#11) and discard.
4. Remove the retaining rings (#10 & #18).
5. Use a bearing puller to remove the ball bearings (#2 & #22).

Breather Removal

1. Remove the hex head cap screw (#29) from the top of the breather assembly (#14).
2. Remove the plain washer (#30), cap (#17) and filter (#15).
3. Use a pipe wrench to remove the breather tube (#16).

⚠ CAUTION ⚠

Do not disassemble the breather assembly.

Slide Bearing Removal

1. Remove the retaining ring (#25) from the bottom of the gearbox guide tube.
2. Remove the hex head cap screw (#28) securing the tube to the gearbox. Heating the cap screw may be necessary to loosen the high strength thread locking compound. On later model machines, cap screw (#28) may not need to be removed to disassemble slide bearings.
3. Slide the slide bearings (#23 & #26) out of the gearbox guide tube.

⚠ CAUTION ⚠

Do not scratch or gouge the gearbox guide tube walls.

Bellows Removal

1. Loosen the four hex head flange screws (page 18, #7) securing the upper bellows ring (page 16, #8) to the gearbox.
2. Slide the bellows, upper bellows ring, lower bellows ring, and flange screws off the gearbox.

Gearbox Assembly

Refer to Gearbox Assembly, page 14.

1. Press the small ball bearing (#22) into the gearbox from the back. Secure with a retaining ring (#18).
2. Press the large ball bearing (#2) into the gearbox from the back. Secure with a retaining ring (#10).
3. Press a new oil seal (#11) into the gearbox. Make sure the oil seal is pressed in straight.
4. Lightly oil the lip of the oil seal and the shaft portion of the pinion (#21). Carefully press the pinion into the gearbox.

⚠ CAUTION ⚠

Do not use excessive pressure to seat the pinion.

5. Install a retaining ring (#4) onto the pinion from inside the gearbox.
6. Press the needle bearing (#6) into the gearbox. The bearing must be pressed in with the numbers and letters facing up. Apply a light coat of oil (see Fluid Levels, page 5 for proper oil type) to the needle bearing after installation.
7. Place a retaining ring (#10) over the large shaft of the crank gear (#20). Press the ball bearing (#2) onto the crank gear.
8. Install a retaining ring (#1) to secure the ball bearing.
9. Press the bearing (#3) into the connecting rod (#5) and secure with a retaining ring (#8).
10. Press the connecting rod onto the offset shaft of the crank gear.
11. Install a retaining ring (#9) to secure the connecting rod.
12. Press the crank gear assembly into the gearbox. Install the snap ring (#10) using a retaining ring pliers inserted through the slot in the crank gear.
13. Install the SAE plug (#19) into the gearbox. Do not over tighten.
14. Replace the breather sub-assembly (#16), filter (#15), cap (#17), and plain washer (#30). Apply medium strength thread locking liquid to the threads of the hex head cap screw (#29) and install.
15. Slide the slide bearing with the hole (#23) into the gearbox tube and align the hole in the bearing with the access hole in the gearbox.
16. Apply high strength thread locker to the hex head cap screw (#28) thread it into the tapped hole above the access hole.

⚠ CAUTION ⚠

The cap screw must thread in completely.

17. Insert the other slide bearing (#26).
18. Secure with the internal retaining ring (#25).
19. Assemble the lower bellows ring (page 16, #3) to one side of the bellows (page 16, #5).

20. Assemble the upper bellows ring (page 16, #8) to the other side of the bellows.
21. Insert four hex head flange screws (page 18, #7) through the upper bellows mount so the head of the screw is wedged between the bellows and the upper bellows mount.
22. Slide the bellows, bellows rings, and hex head flange screws over the gearbox guide tube with the upper bellows ring toward the gearbox.
23. Thread the hex head flange screws into the gearbox to secure the bellows.
24. Apply a light coat of oil (see Fluid Levels, page 5 for proper oil type) to all bearings after installation is complete.

Lower Unit Disassembly

NOTE: The lower unit can be separated from the drive unit (engine, gearbox and handle) without completely disassembling the rammer. If the lower unit has not already been separated, follow the "Gearbox Removal" instructions.

Refer to Lower Unit Assembly, page 16.

Shoe and Springbox Guard Removal

1. Remove the four hex head cap screws and lockwashers (page 18 #11 & #12) that secure the lower unit assembly (page 18 #3) to the shoe (page 18 #13).
2. Remove the shoe.
3. Lift the springbox guard off the springbox and ram head assembly.
4. Remove the o-ring (#13) from the springbox guard.

Springbox Disassembly

⚠ WARNING ⚠

Working with compressed springs! Failure to follow the next set of steps very carefully could result in injury or death.

1. Flip the springbox assembly upside down.
2. Insert the springbox tool (MBW #06468) rods into the springbox assembly as shown in Figure 3.

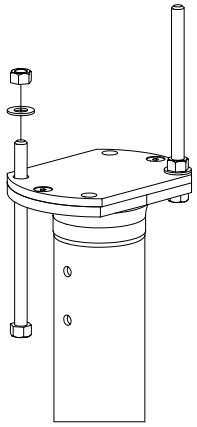


Figure 3

3. Make sure the rods are 180° apart.
4. Place the washers over the rods and run the nuts down so the washers are snug against the cover (#12).
5. Remove the flat head socket screws (#18) holding the cover to the springbox.
6. While holding the bottom of the rods from turning, slowly and evenly back off the nuts on the cover side.
7. After the tension is removed from the cover, the springbox tools and the cover can be removed.
8. Remove the o-ring (#1) from the cover.
9. The lower springs (#6 & #7) can be removed from the springbox (#15).
10. Place a drift pin or steel rod through the piston hole in the ram head (#17). Use this to hold the ram head from turning while removing the hex head cap screw and lockwasher (#20 & #21).
11. Remove the washers (#110), piston (#11), spacer (#114), and upper springs (#6 & #7).

Lower Unit Assembly

⚠ WARNING ⚠

Working with compressed springs! Failure to follow the next set of steps very carefully could result in injury or death.

Refer to Lower Unit Assembly, page 16.

1. Turn springbox (#15) up side down and insert the upper springs (#6 & #7).
2. Install the ram head (#17) and add the washers (#10), the piston (#11), and the spacer (#14).
3. Apply medium strength thread locker to the hex head cap screw (#20) and install it, along with a lockwasher (#21), into the ram head. Torque to 50 ft lbs (68 N•m).
4. Insert the lower springs (#6 & #7).

5. Lightly grease the o-ring groove in the cover (#12) and install a new o-ring (#1).
6. Insert the springbox tool (MBW #06468) rods into the springbox as shown in Figure 4.

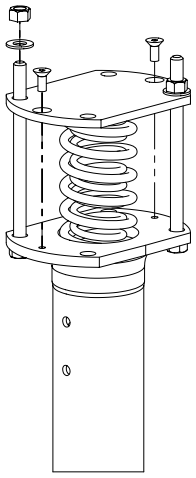


Figure 4

7. Slowly draw the cover down onto the springbox by alternately tightening each rod.

⚠ WARNING ⚠

Keep the cover level with the springbox.

8. Secure the cover with two flat head socket screws (#18) torqued to 8 ft lbs (11 N•m).
9. Remove the springbox tool rods from the assembly.
10. The springbox warning decal (page 2, #01326) should be clean and highly visible. If not, the old decal should be completely removed and replaced with a new decal.
11. Lightly oil a new o-ring (#13) and place it into the groove in the springbox guard (#9).
12. Slide the springbox guard over the ram head onto the springbox. Be careful not to damage the o-ring during installation.
13. Place the springbox assembly onto the shoe (page 18 #13) with the fill plug (#4) pointing toward the back of the shoe.
14. Install four hex head cap screws and lockwashers (page 18 #21 & #22). Torque the cap screws to 40 ft lbs (56 N•m).

Gearbox and Lower Unit Assembly

Refer to Gearbox and Lower Unit Assembly, page 18.

1. Rotate the ram head (page 16, #17) in the lower unit so the threaded hole on top is positioned toward the front of the shoe (#13).
2. Slide the gearbox assembly onto the lower unit.
3. Align the connecting rod (page 14, #5) with the ram head and install the piston pin (#5) with the groove in the pin facing out.
4. Align the groove in the piston pin with the hole for the setscrew (#9).
5. Install the setscrew into the ram head finger tight, then back off 1/4 turn. Lock the setscrew in place with the hex nut (#10). Make sure setscrew is in groove.

⚠ CAUTION ⚠

The piston pin must be able to rotate.

6. Rotate the gearbox assembly so the front of the gearbox is aligned with the front of the lower unit.
7. Secure the lower bellows mount to the springbox guard using six hex head flange screws (page 16, #19). Torque to 12 ft lbs (16 N•m).
8. Apply a light coat of oil to all of the bearings in the gearbox assembly.
9. Tip the assembly back and place a new gasket (#6) over the gearbox face.
10. Insert the dowel pins (#1) into the gearbox through the holes in the gasket.
11. Align the holes in the cover (#2) with the dowel pins and place the cover on the gasket.
12. Secure the cover to the gearbox using four hex head flange screws (#8) with medium strength thread locker. Tighten the flange screws equally and torque to 12 ft lbs (16 N•m).
13. The gasket will compress slightly after initial tightening, re-torque the flange screws after 5 minutes.
14. If the handle brackets (page 20, #17, #22 or #23) were removed, apply medium strength thread locker to the four socket head cap screws (page 20, #29) before assembly. Torque to 35 ft lbs (47 N•m).
15. Fill the unit with oil according to the Changing Percussion System Oil section on page 6.

Parts Replacement Cycles and Tolerances

Bearings	Replace anytime a bearing is rough, binding, discolored or removed from housing or shaft.
Bellows	Replace when they are worn, cracked, or to the point of leaking.
Clutch	Replace clutch if shoes and/or springs show signs of heat damage or if it does not disengage below 2000 rpm.
Crank Gear	Replace if teeth are cracked or if they become sharp.
Engine Components	Refer to your engine manufacturer's Owner's Manual.
Guide Bushings	Replace if a 0.025" (0.635 mm) feeler gauge can be slid between the springbox and the guide tube.
Hardware	Replace any worn or damaged hardware as needed. Replacement hardware should be grade 5 and zinc plated unless otherwise specified.
Pinion	Replace if teeth are cracked or if they become sharp. Replace if the drum is scored or gouged deeper than 0.03" (0.76 mm).
Piston (Springbox)	Replace if a 0.025" (0.635 mm) feeler gauge can be slid between the springbox and the piston.
Piston Pin	Replace if the outside diameter is less than 0.620" (15.75 mm).
Piston Washers	Replace if washers are dished.
Safety Decals	Replace if they become damaged or illegible.
Seals & Gaskets	Replace if a leak is detected and at every overhaul or teardown.
Springs	Replace if a flat spot on the side of a spring is greater than 0.09" (2 mm). Replace if the free length is less than 6.75" (171 mm). Replace ALL springs at the same time.
Springbox Bushing (Bronze)	Replace if inner diameter is larger than, 0.890" (22.7 mm) Prior to serials: 4270632-420HC 4200387-420R service limit is 0.853" (21.7 mm) 4250661-420H

Replacement Parts

The warranty is stated in this book on page 17. Failure to return the Warranty Registration Card renders the warranty null and void.

MBW has established a network of reputable distributors/ dealers with trained mechanics and full facilities for maintenance and rebuilding, and to carry an adequate parts stock in all areas of the country. Their sales engineers are available for professional consultation. If you cannot locate an MBW distributor in your area, contact MBW or one of our Sales Branches listed below.

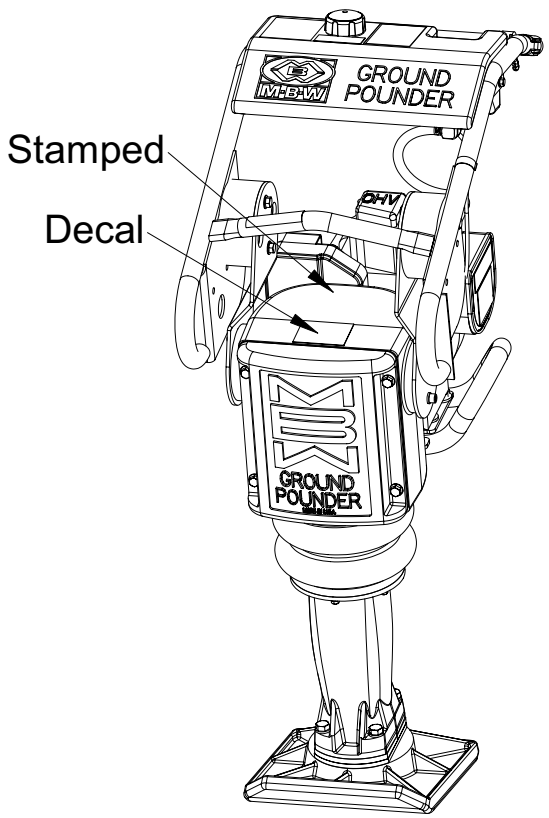
When ordering replacement parts, be sure to have the following information available:

- Model and Serial Number of machine when ordering MBW parts
- Model and Serial Number of engine when ordering engine parts
- Part Number, Description, and Quantity
- Company Name, Address, Zip Code, and Purchase Order Number
- Preferred method of shipping

REMEMBER - You own the best! If repairs are needed, use only MBW parts purchased from authorized MBW distributors.

Write Model Number here

Write Serial Number here



The unit's serial number can be found in the following locations:

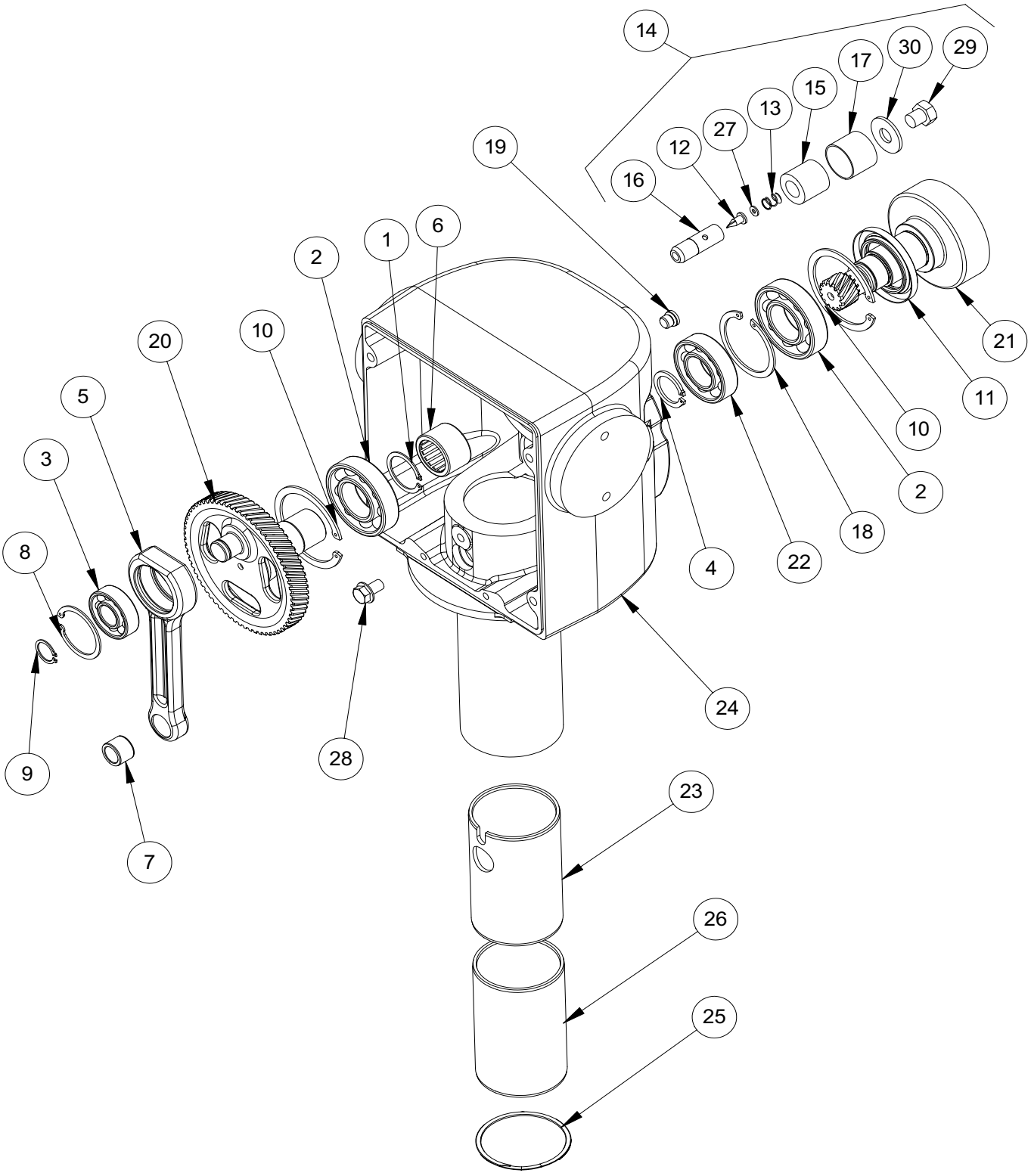
- The serial number decal is located on the top of the gearbox.
- The serial number is also stamped on the top of the gearbox.

Contact Information

MBW, Inc.
250 Hartford Rd • PO Box 440
Slinger, WI 53086-0440
Phone: (262) 644-5234
Fax: (262) 644-5169
Email: mbw@mbw.com
Website: www.mbw.com

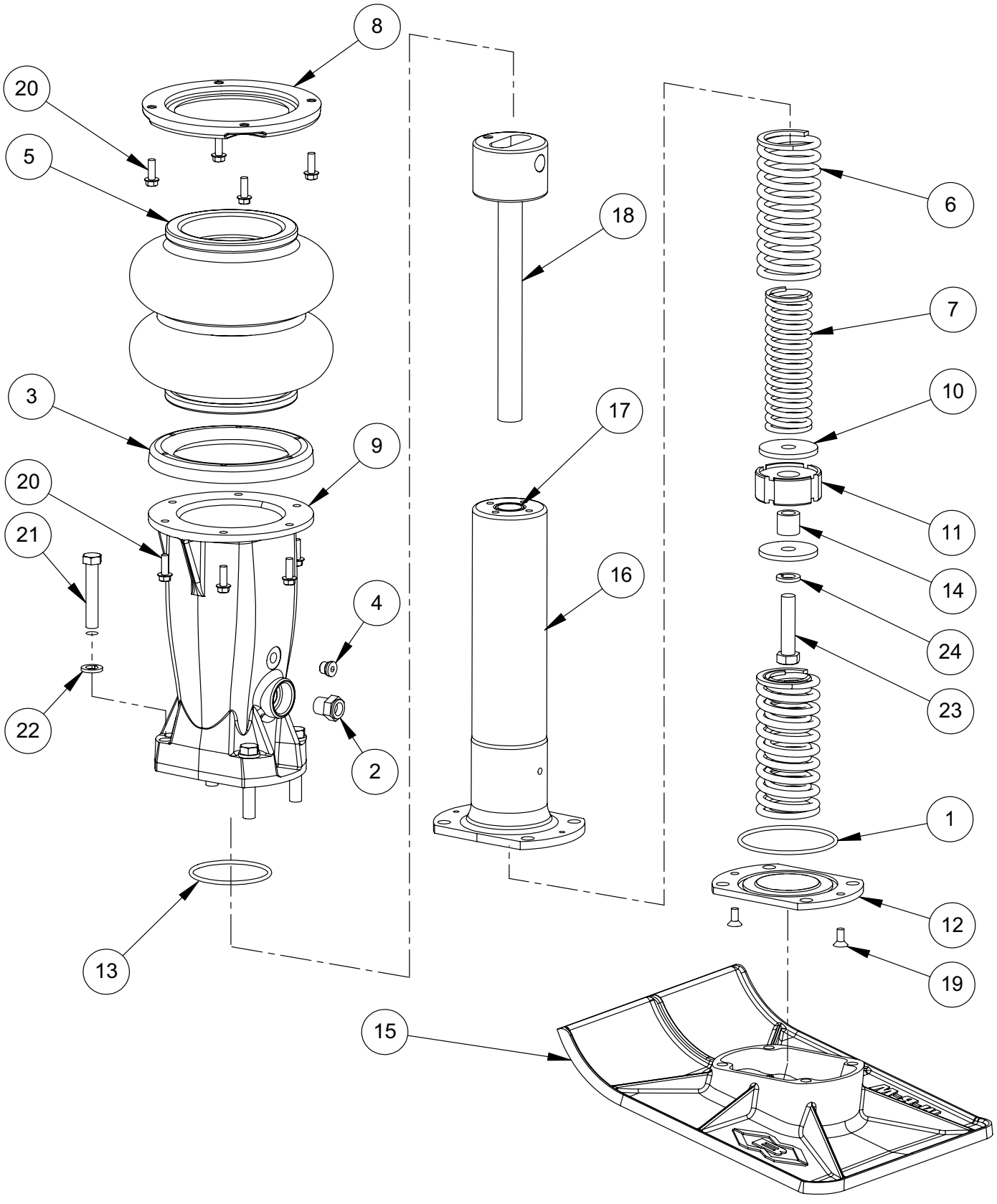
MBW (UK) Ltd.
Unit 6, Bradley Fold Trading Estate
Radcliffe Moor Road
Bolton BL2 6RT, England
Phone: 01204 387784
Fax: 01204 387797

MBW FRANCE S.A.R.L.
Z.A. d'Outreville
11 rue Jean Baptiste Néron,
60540 BORNEL
FRANCE
Teléfono: +33 (0) 3 44 07 15 96
Fax: +33 (0) 3 44 07 41 28
Correo electrónico: mbwfrance@free.fr



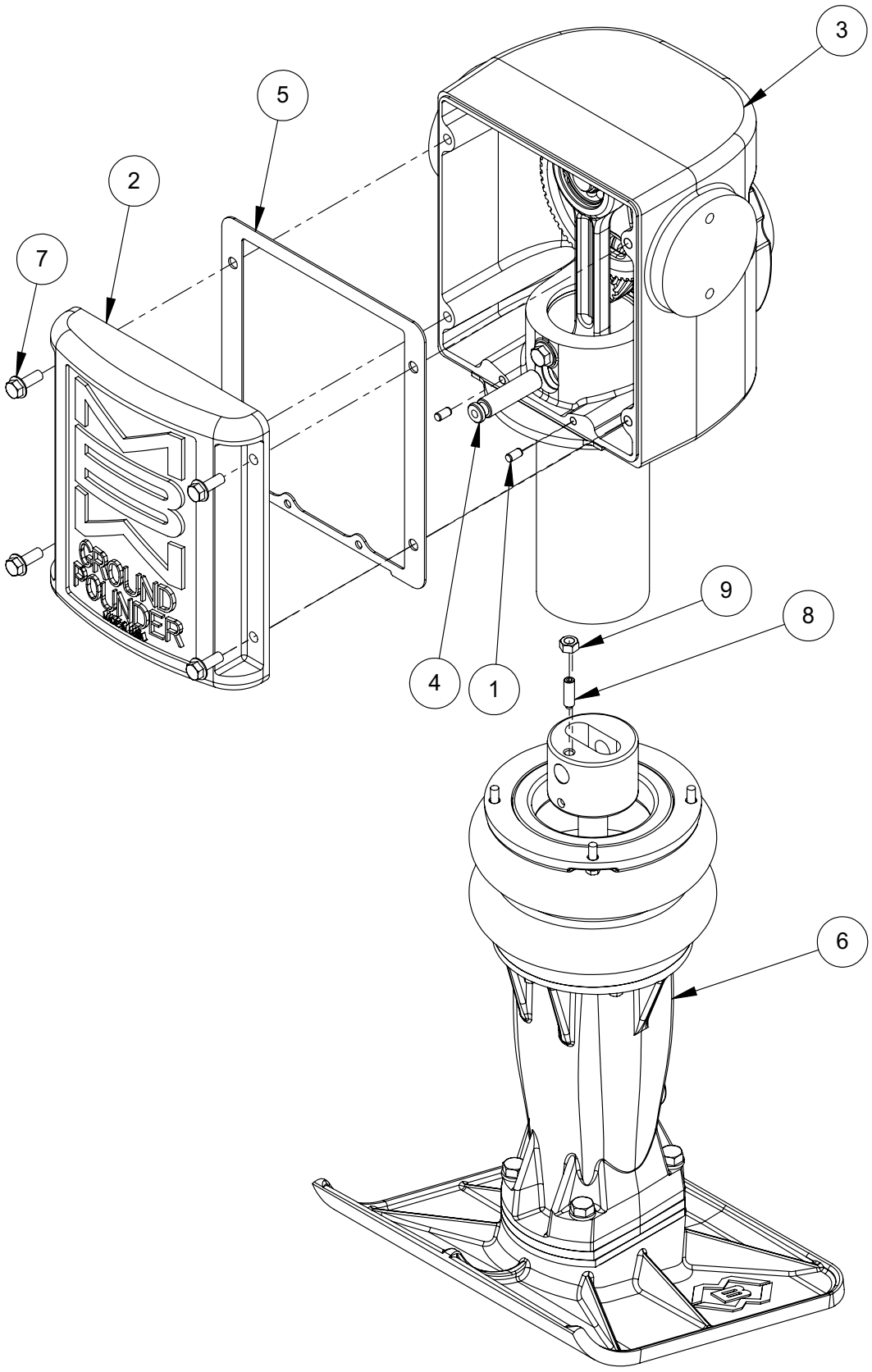
Gearbox Assembly

ITEM	PART NO.	DESCRIPTION	QTY
1.	01001	RETAINING RING, EXT. 5100-137	1
2.	01103	BEARING, BALL	2
3.	01105	BEARING, BALL	1
4.	01244	RETIANING RING, EXT. 5160-112	1
5.	06161	ROD ASSEMBLY, CONNECTING	1
6.	06259	BEARING, NEEDLE	1
7.	06262	BUSHING	1
8.	06264	RETAINING RING, INT. N5000-187	1
9.	06265	RETAINING RING, EXT. 5100-78	1
10.	06266	RETINAING RING, INT. N5000-281	2
11.	06274	SEAL	1
12.	06413	VALVE	1
13.	06423	SPRING, COMPRESSION, 0.420 OD	1
14.	06904	BREATHER ASSEMBLY (Includes items 12, 13, 15, 16, 17, 29, 27, 30)	1
15.	06905	FILTER, BREATHER	1
16.	06908	TUBE, BREATHER	1
17.	06910	COVER	1
18.	09476	RETAINING RING, INT. N500-244	1
19.	09618	FITTING, PLUG PARKER 4HP50N	1
20.	13733	GEAR	1
21.	15959	PINION	1
22.	16021	BEARING, BALL	1
23.	16304	BEARING, SLIDE, CUT	1
24.	16315	GEARBOX***	1
25.	16451	RETAINING RING, INTERNAL, 3.0”	1
26.	16745	BEARING, SLIDE	1
27.	F01PW	WASHER,5/32 X 3/8 X 18 GA ZP	1
28.	F061605FWS	FLANGE HEAD CAP SCREW, 3/8-16 X 5/8 GR5 ZP	1
29.	F081304HCS	HEX HEAD CAP SCREW, 1/2-13 X 1/2 GR5 ZP	1
30.	F08SW	WASHER, 9/16 X 1-3/8 X 12 GA ZP	1
		***INCLUDES GEARBOX TUBE. GEARBOX TUBE NOT AVAILABLE SEPARATELY.	



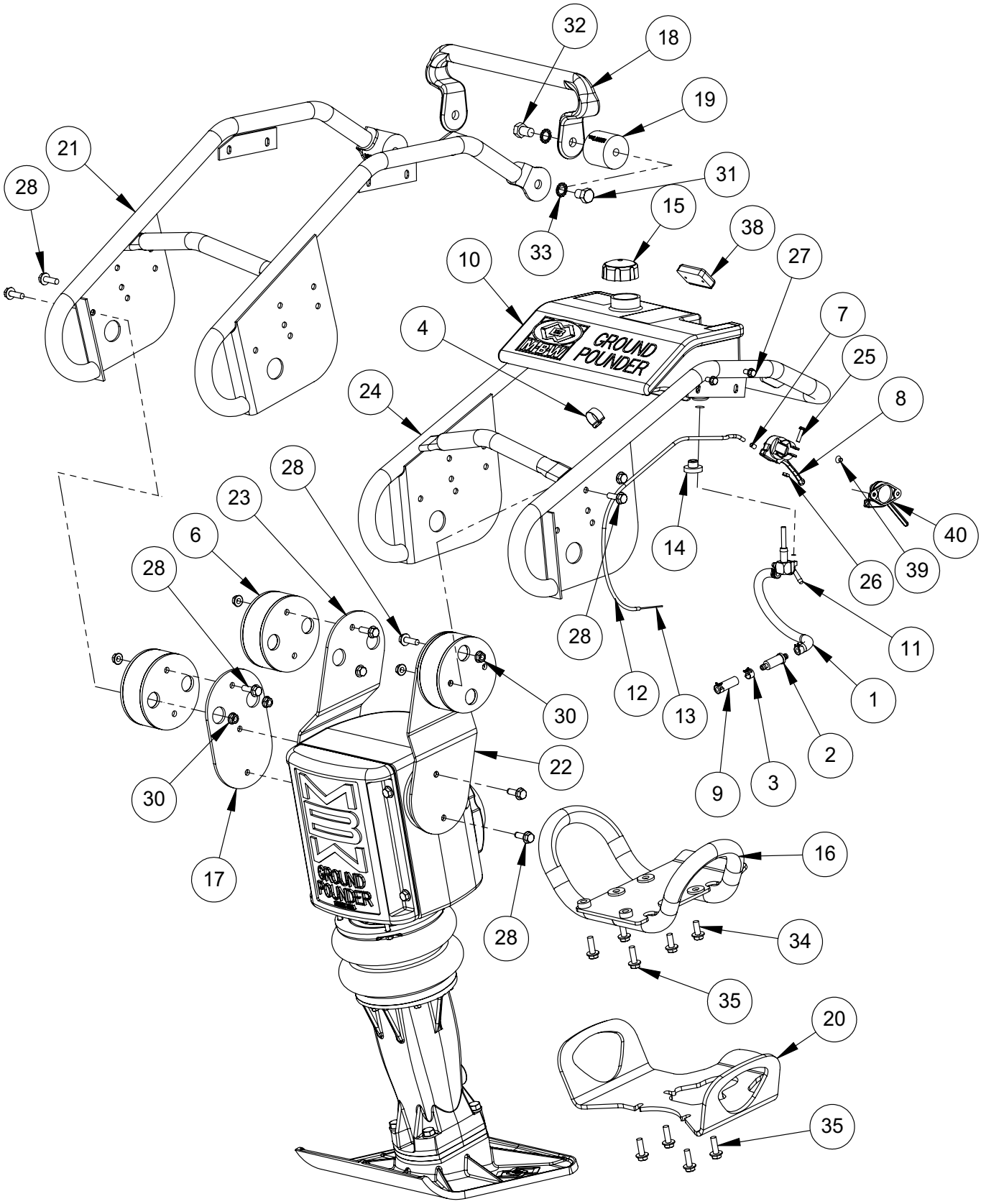
Lower Unit Assembly

ITEM	PART NO.	DESCRIPTION	QTY
1.	06239	O-RING, 3.36 ID X 0.139 DIA	1
2.	06457	GAGE, VIEW	1
3.	07154	RING, CLAMPING, LOWER	1
4.	09618	FITTING, PLUG PARKER 4HP50N	1
5.	11694	BELLOWS, 4 PLY	1
6.	16305	SPRING, COMPRESSION, 2.313 OD	2
7.	16306	SPRING, COMPRESSION, 1.700 OD	2
8.	16311	RING, CLAMPING, UPPER	1
9.	16320	GUARD, SPRINGBOX	1
10.	16323	WASHER, 2.125 OD X 0.516 ID	2
11.	16324	PISTON	1
12.	16325	COVER, SPRINGBOX	1
13.	16330	O-RING, 2.72 ID X 0.139 DIAMETER	1
14.	16423	SPACER	1
15.	17172	SHOE, 10", 15^{O}	1
	16317	SHOE, 10", 12^{O} (420R ONLY)	1
	19618	SHOE, 11" CAST IRON (421 MODELS) (**INCLUDES ITEMS #21 & 22)**	1
16.	17416	SPRING BOX	1
17.	18475	BUSHING	1
	16326	BUSHING (For use with serial #4270632 - 420HC, 4200387 - 420R, 4250661 - 420H and below)	1
18.	18524	SHAFT, RAM 420	1
19.	F042005FSS	FSS, 1/4-20 x 5/8"	2
20.	F042006FWS	FWLS, 1/4-20x3/4 ZP	10
21.	F072020HCS	HHCS, 7/16-20 X 2-1/2 GR5 ZP (For cast iron shoes #19618 only)	4
	F072022HCS	HHCS, 7/16-20 X 2-3/4 GR5 ZP (For aluminum shoes #17172 & 16317 only)	4
22.	F07LW	LOCKWASHER, 7/16 ZP	4
23.	F081318HCS	HHCS, 1/2-13 x 2-1/4 GR5 ZP	1
24.	F08LW	LOCKWASHER, 1/2 ZP	1
		***Prior to 420H serial no. 4250150 & 420R serial no. 4200300, order replacement kit #17423 (Includes items 9,15)	
	19620	SPRING BOX ASM. (INCLUDES ITEMS 1, 6, 7, 10 thru 14, 16 thru19, 23 & 24)	



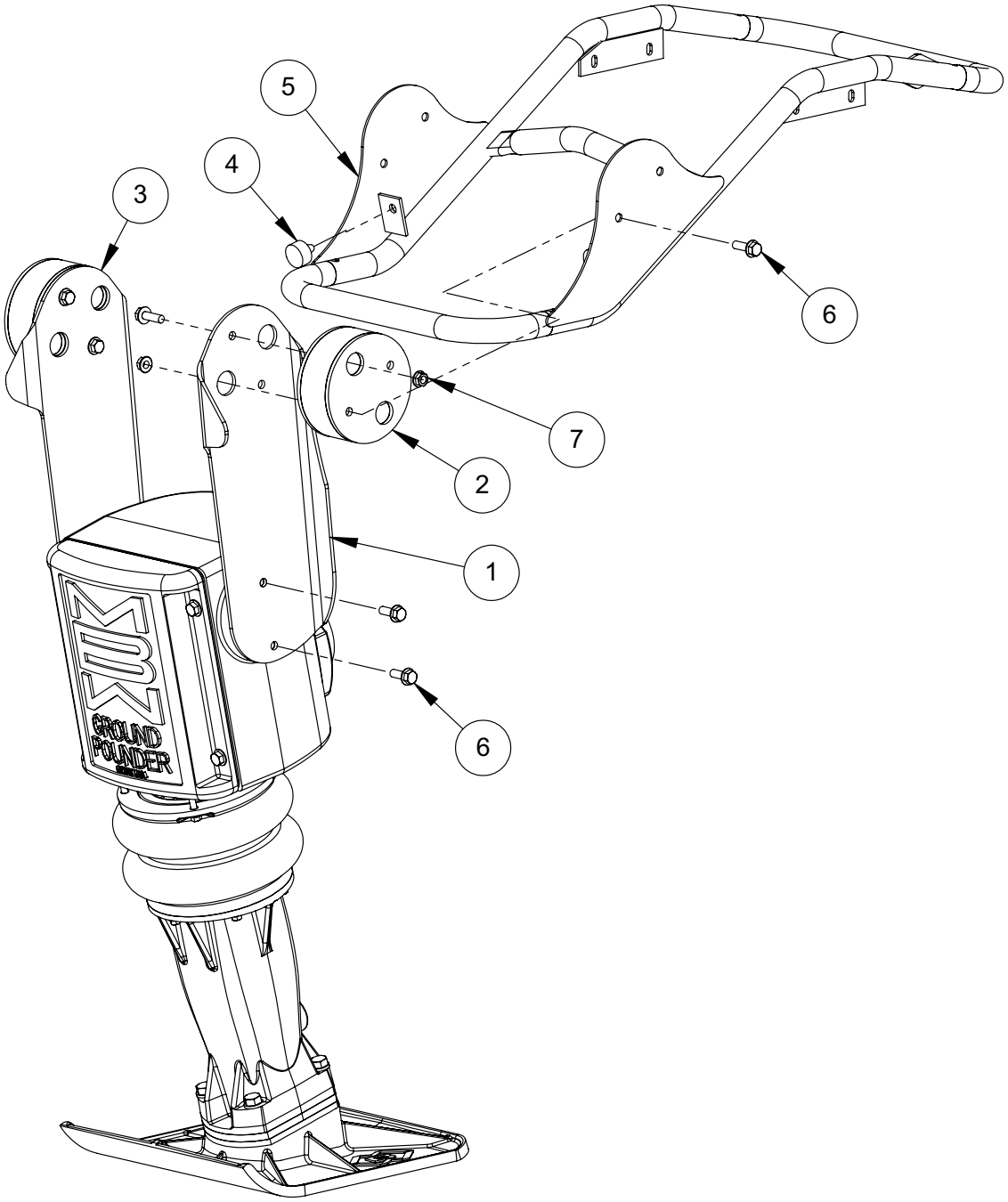
Gearbox and Lower Unit Assembly

ITEM	PART NO.	DESCRIPTION	QTY
1.	07203	PIN,DOWEL 1/4 x 1/2	2
2.	16313	COVER, RAMMER GEARBOX	1
3.	16334	GEARBOX ASSEMBLY (See page 14 for breakdown)	1
4.	16349	PIN, GROOVED	1
5.	16361	GASKET, COVER	1
6.	19619	LOWER UNIT, 420	1
	19617	LOWER UNIT, 421	1
7.	F051807FWS	FLANGE SCREW,5/16-18 x 7/8 ZP	4
8.	F051810SSSD	SOCKET HEAD SET SCREW, 5/16-18UNC X1.25LG DOG PT	1
9.	F0518HN	NUT,HEX 5/16-18 ZP	1
		OPTIONAL ACCESSORIES	
	16896	EXTENSION, TRENCH SHOE, 6”	
	16934	KIT, 4” TRENCH SHOE	
	16935	KIT, 6” TRENCH SHOE	



Handle Assembly

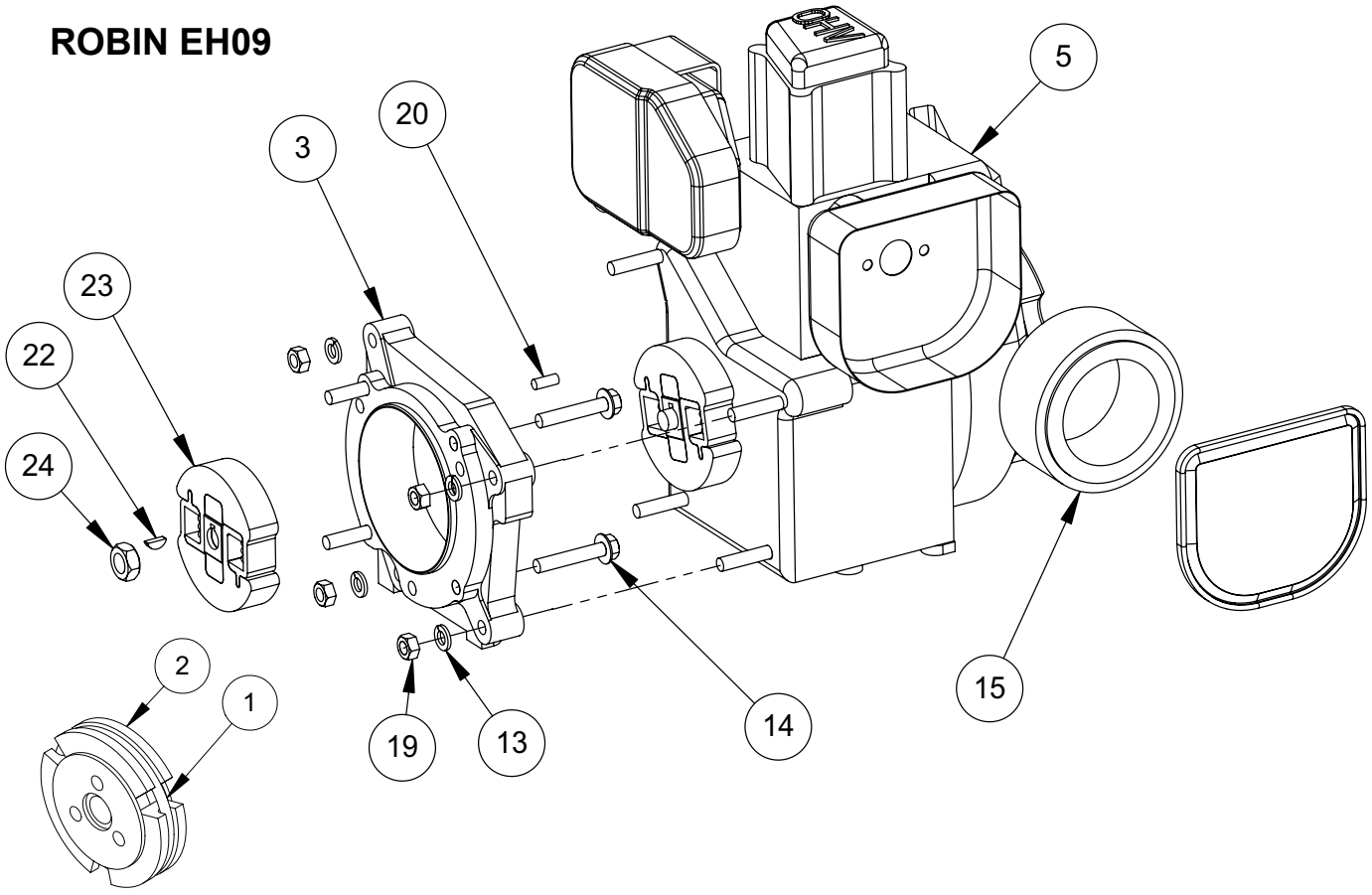
ITEM	PART NO.	DESCRIPTION	QTY
1.	01035	HOSE, FUEL 6” LONG (420H only)	1
	17720	HOSE, FUEL 7-1/2” LONG (420R and 420HC only)	1
2.	01045	FILTER, FUEL, IN-LINE	1
3.	01052	CLAMP, HOSE	4
4.	01145	CLAMP, SPRING	1
6.	07351	TORSION MOUNT	2
7.	07916	FERRULE, THROTTLE LEVER	1
8.	14715	THROTTLE, RATCHET STYLE	1
9.	15183	HOSE, FUEL 1-1/2” LONG	1
10.	16303	TANK, FUEL	1
11.	16414	VALVE, FUEL	1
12.	16572	CASING, 30" THROTTLE WIRE	1
13.	16573	WIRE, 34.5" THROTTLE	1
14.	16586	GROMMET, 1/2”	1
15.	16666	CAP, 1-3/4” (USE ON ROBIN AND HONDA FLOAT CARBURATOR ENGINES)	1
	14714	CAP, 1-3/4” (USE ON HONDA DIAPHRAGM CARBURATOR ENGINES)	
16.	16671	GUARD, ENGINE (420R only)	1
17.	16754	BRACKET, HANDLE (420H only)	2
18.	17162	SUB-HANDLE (420H only)	1
19.	17170	SHOCKMOUNT (420H only)	2
20.	18527	GUARD, ENGINE	1
21.	18879	HANDLE (420H only)	1
22.	17477	BRACKET, HANDLE, LEFT (420R and 420HC only)	1
23.	17478	BRACKET, HANDLE, RIGHT (420R and 420HC only)	1
24	17481	HANDLE (420R & 420HC ONLY)	1
	18881	HANDLE (420R & 420HC ONLY) **SERIAL NO. (4200395 420R/4271101 420HC) AND UP**	1
25.	F033206PMS	PAN HEAD MACHINE SCREW, #10-32 x 3/4” LG ZP	1
26.	F0332HN	NUT, HEX #10-32 ZP	1
27.	F042004FWS	FLANGE SCREW, 1/4”-20 x 1/2” ZP	4
28.	F051808FWS	FLANGE SCREW, 5/16”-18 x 1” ZP	12
30.	F0518FN	NUT, FLANGE 5/16”-18 ZP	8
31.	F081305HCS	HEX HEAD CAP SCREW, 1/2”-13 x 5/8” ZP	2
32.	F081306HCS	HEX HEAD CAP SCREW, 1/2”-13 x 3/4” ZP	2
33.	M12ETLW	LOCKWASHER, M12, EXTERNAL TOOTH, ZP	4
34.	M08C020FWS	FLANGE SCREW, M8-1.25 x 20MM ZP	4
35.	M08C025FWS	FLANGE SCREW, M8-1.25 x 25MM ZP	4
36.			
38.	17602	KIT, TACHOMETER	
39.	F032402FSS	FLAT HEAD SCREW, #10-24x1/4”, **SERIAL NO. (4200395 420R/4271101 420HC) AND UP**	2
40.	18742	THROTTLE, FLANGE MOUNT, **SERIAL NO. (4200395 420R/4271101 420HC) AND UP**	1



Handle

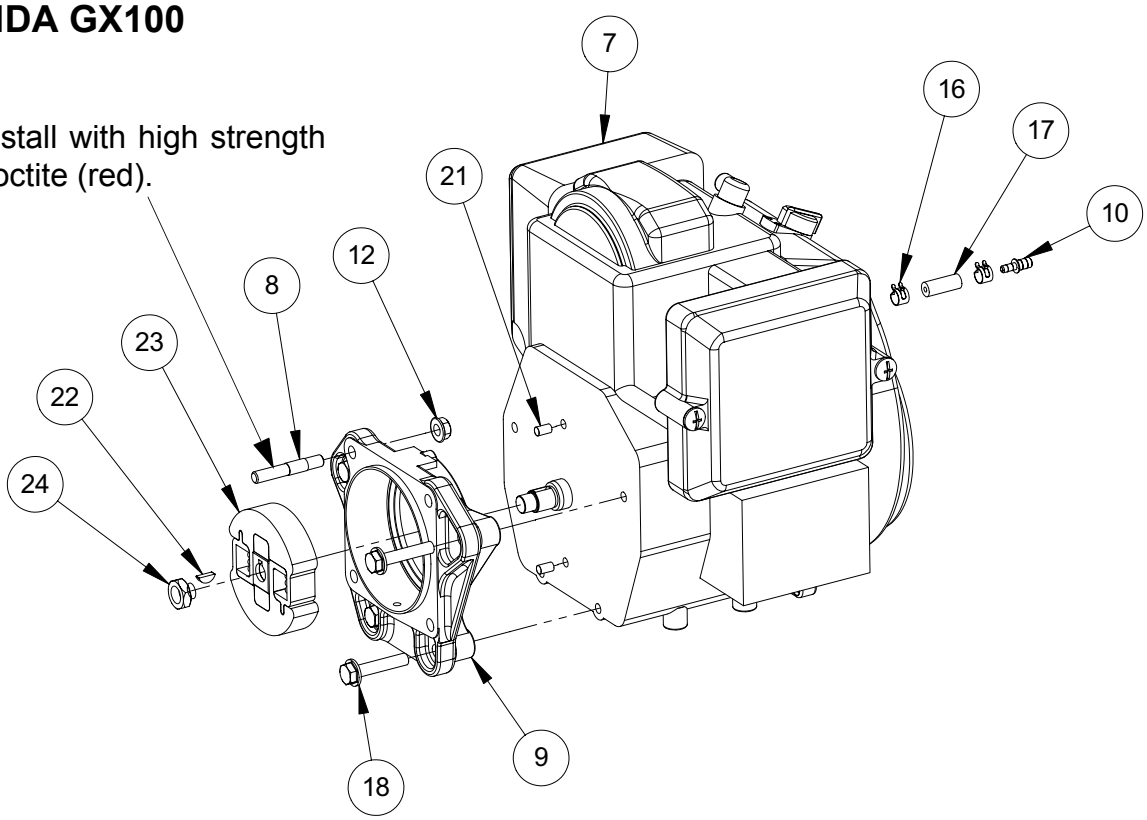
ITEM	PART NO.	DESCRIPTION	QTY
1.	18511	HANDLE SUPPORT, LEFT	1
2.	07351	TORSION MOUNT	2
3.	18510	HANDLE SUPPORT, RIGHT	1
4.	18515	SNUBBER	2
5.	18883	RAMMER HANDLE	1
6.	F051808FWS	FLANGE SCREW, 5/16”-18 x 1” ZP	12
7.	F0518FN	NUT, FLANGE 5/16”-18 x 7/8	8

ROBIN EH09



HONDA GX100

Install with high strength Loctite (red).



Engine Assembly

ITEM	PART NO.	DESCRIPTION	QTY
1.	01581	SPRING (See note below)	1
2.	06026	KIT,SHOE & SPRING (Includes item 1 and three shoes, see note below)	1
3.	16433	ADAPTER, EH09	1
5.	16450	ENGINE ASSEMBLY, EH09 (Includes items 22, 23 and 24. Also	1
		includes items 7, 12, 13, and 40 on page 20)	
7.	17196	ENGINE ASSEMBLY, GX100 (FLOAT CARBURATOR)	1
		(Includes items 9, 10, 16, 17, 22, 23 & 24. Also includes 7, 12 ,13, & 40 on page 20)	
	18530	ENGINE ASSEMBLY, GX100 (DIAPHRAGM CARBURATOR)	
8.	17164	STUD (420H only) Mounted in gearbox (#4 page 18). Install with red-high strength loctite.	4
9.	17197	ADAPTER, GX100	1
10.	17217	REDUCER, BARBED	1
12.	F0518FN	NUT, FLANGE 5/16-18 ZP	4
13.	F05LW	LOCKWASHER,5/16 ZP	4
14.	F051814FWS	FLANGE SCREW, 5/16-18 x 1-3/4 GR5 ZP	4
15.	J2743260307	ELEMENT (ROBIN EH09)	1
	Q5580402	ELEMENT (HONDA GX100)	1
16.		CLIP, FUEL LINE (Not provided by MBW Inc.)	2
17.		FUEL LINE, 3/16 ID (Not provided by MBW Inc.)	1
		CUT TO 3” FOR MODELS USING HANDLE MBW #17206 CUT TO 5” FOR MODELS USING HANDLE MBW #18553	
18.		HEX HEAD FLANGE SCREW, M8-1.25 X 40mm (Not provided by MBW Inc.)	4
19.		NUT, HEX 8mm-1.25 (Not provided by MBW Inc.)	4
20.		PIN, DOWEL, 6mm X 15mm (420R) (Not provided by MBW Inc.)	2
21.		PIN, DOWEL, 6mm X 10mm (420H) (Not provided by MBW Inc.)	2
22	18053	KEY, WOODRUFF, METRIC 4X13	1
23	17593	CLUTCH, RAMMER, 4-STROKE	1
24	M12CHJN	NUT, HEX JAM M12 X 1.25 ZP	1
		Note: Service items 1 and 2 may be ordered for clutch rebuild only.	
		After machine Serial Numbers listed below, new clutch (Item 23) used. 420R - 4200381	
		420H - 4250577 420HC - 4270457	

WARRANTY

WHAT DOES THIS WARRANTY COVER? MBW, Incorporated (MBW) warrants each New Machine against defects in material and workmanship for a period of twelve (12) months. "New Machine" means a machine shipped directly from MBW or authorized MBW dealer to the end user. This warranty commences on the first day the machine is sold, assigned to a rental fleet, or otherwise put to first use.

MBW warrants each Demonstration Machine against defects in material and workmanship for a period of six (6) months. "Demonstration Machine" means a machine used by MBW or its agents for promotional purposes. This warranty commences on the first day the machine is sold, assigned to a rental fleet, or otherwise put to first use.

This warranty covers the labor cost for replacement or repair of parts, components, or equipment on New Machines or Demonstration Machines, and MBW shall pay labor costs at MBW's prevailing rate to affect the warranted repair or replacement. MBW reserves the right to adjust labor claims on a claim-by-claim basis.

This warranty covers the shipping cost of replacement parts, components, or equipment via common ground carriers from MBW to an authorized MBW dealer. Air freight is considered only in cases where ground transportation is not practical.

MAY THIS WARRANTY BE TRANSFERRED? This warranty is non-transferable and only applies to the original end user of a new machine or demonstration machine.

WHAT DOES THIS WARRANTY NOT COVER?

1.This warranty does not cover any Used Equipment. "Used Equipment" means any MBW machine or equipment that is not a New Machine or a Demonstration Machine. All Used Equipment is sold **AS IS/WHERE IS WITH ALL FAULTS.**

2.This warranty does not cover any New Machine, Demonstration Machine, or their equipment, parts, or components altered or modified in any way without MBW's prior written consent. This warranty does not cover the use of parts not specifically approved by MBW for use on MBW products. This warranty does not cover misuse, neglect, shipping damage, accidents, acts of God, the operation of any New Machine or Demonstration Machine in any way other than recommended by MBW in accordance with its specifications, or any other circumstances beyond MBW's control. This warranty does not cover any New Machine or Demonstration Machine repaired by anyone other than MBW factory branches or authorized MBW distributors.

3.This warranty does not cover, and MBW affirmatively disclaims, liability for any damage or injury resulting directly or indirectly from design, materials, or operation of a New Machine or Demonstration Machine or any other MBW product. MBW's liability with respect to any breach of warranty shall be limited to the provisions of this document and in no event shall exceed an amount equal to the purchase price of the New Machine or Demonstration Machine purchased from MBW.

4.This warranty does not cover engines, motors, and other assemblies or components produced by other manufacturers and used on a New Machine or Demonstration Machine, as said engines, motors, and other assemblies or components may have warranties provided by the manufacturer thereof. This warranty does not apply to consumable items, such as v-belts, filters, trowel and screed blades, seals, shock mounts, batteries, and the like, all of which are sold AS IS/WHERE IS WITH ALL FAULTS.

5.This warranty does not cover the cost of transportation and other expenses which may be connected with warranty service but not specifically mentioned herein.

6.This warranty does not cover any updates to any New Machine, Demonstration Machine, or any other MBW product. MBW reserves the right to improve or make product changes without incurring any obligation to update, refit, or install the same on New Machines or Demonstration Machines previously sold.

WHAT MUST YOU DO TO OBTAIN WARRANTY COVERAGE? Each New Machine or Demonstration Machine is accompanied by a Warranty Registration Card. You must sign, date, and return the Warranty Registration Card to the place of origin of the New Machine or Demonstration Machine, either to MBW, Inc. at P.O. Box 440, Slinger, Wisconsin 53086, MBW (UK), Ltd. at Units 2 & 3 Cochrane Street, Bolton BL3 6BN, United Kingdom or MBW FRANCE SARL at ZA D'Outreville, 5 Rue Jean Baptiste Neron, Bornel 60540 France, within ten (10) days after purchase, assignment to a rental fleet, or first use. This signed warranty card is the buyer's affirmation that he has read, understood, and accepted the warranty at the time of purchase. Failure to return the warranty card as specified herein renders the warranty null and void. In order to receive warranty coverage consideration, warranty claims must be submitted within thirty (30) days after the New Machine or Demonstration Machine fails. Warranty claims must be submitted to MBW, Inc., MBW (UK), Ltd. or MBW FRANCE SARL, and written authorization for the return of merchandise or parts under the warranty must be obtained before shipment to MBW.

WHAT WILL MBW DO? MBW's obligation under this warranty is limited to the replacement or repair of parts for a New Machine or Demonstration Machine at MBW factory branches or at authorized MBW distributors, and such replacement or repair is the exclusive remedy provided hereunder. Labor must be performed at an authorized MBW distributor. MBW reserves the right to inspect and render a final decision on each warranty case, and MBW's repair or replacement is solely within the discretion of MBW.

IT IS EXPRESSLY AGREED THAT THIS SHALL BE THE SOLE AND EXCLUSIVE REMEDY UNDER THIS WARRANTY. UNDER NO CIRCUMSTANCES SHALL MBW BE LIABLE FOR ANY COSTS, LOSS, EXPENSE, DAMAGES, SPECIAL DAMAGES, INCIDENTAL DAMAGES, OR PUNITIVE DAMAGES ARISING DIRECTLY OR INDIRECTLY FROM THE USE OF THE NEW MACHINE OR DEMONSTRATION MACHINE WHETHER BASED UPON WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY, OR ANY OTHER LEGAL THEORY.

THE FOREGOING WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR USE, AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL OTHER OBLIGATIONS OR LIABILITY ON MBW'S PART. MBW NEITHER ASSUMES NOR AUTHORIZES ANY OTHER PERSON TO ASSUME ON BEHALF OF MBW ANY OTHER LIABILITY OR WARRANTY IN CONNECTION WITH THE SALE OR SERVICE OF ANY NEW MACHINE, DEMONSTRATION MACHINE , OR ANY OTHER MBW PRODUCT.

NOTES

NOTES